Keeping the Books for Environmental Systems: Emergy Accounts for West Virginia

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It is a fact that some players do more for their team!

Quarterback Tom Brady #12 of the New England Patriots takes the snap during Super Bowl XXXIX. Harry How, Getty Images

A Sports Analogy: The USA is a winning team with a strong economy and a high standard of living. West Virginia is a key player on Team USA, but the benefits West Virginia obtains under the present contract are not commensurate with West Virginia's contributions made towards the teams success.

Is it time to renegotiate the contract?

Hawk's Nest Photo from West Virginia Dept. Tourism

Conventional Wisdom

The dollars flowing in and out of the state are about equal, so what's the problem?

How We Found Out That There Was a Problem.

1. Real wealth is not measured by money. Real wealth is what an item can do when it is used. A gallon of gas can drive a car only so far, regardless of the price paid at the pump!
2. Accounts for environmental systems cannot be kept in dollars alone, because these systems are based on the work of both humanity and the work of ecosystems, for which no money is paid.
3. We knew that the balance of real wealth entering and leaving the state was a potential problem because of West Virginia's large coal exports, and low social welfare measures (CVI 2002).
4. To find out for sure we needed an accounting system that could determine the balance of real wealth to be used in parallel with monetary accounting.

Mountaintop removal/valley fill coal mining in West Virginia.
Photos by Vivian Stockman

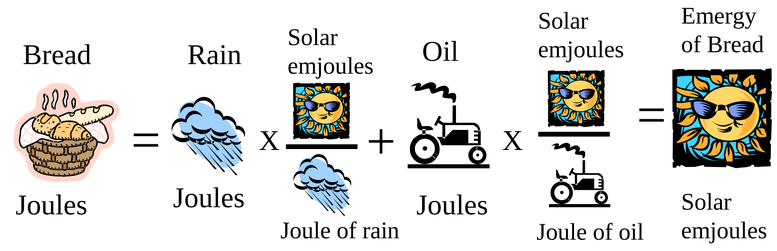
The Solution: Environmental Accounting Using Emergy

1. Constructing accounts for real wealth requires that we evaluate flows and storages of energy, matter, and information, which may or may not be accompanied by flows of money.
2. Energy can be used as a common denominator for quantifying all these flows, because energy transformations accompany all actions.
3. Since energies of different kinds have different ability to do work, flows of energy must be converted to emergy to put work done by the economy and the environment on the same scale.
4. The key synthesis made possible by H.T. Odum's emergy accounting is the expression of social, economic and environmental flows in common terms, on an objective basis, so that they are directly comparable.
5. Thus, for the first time, what is exported from West Virginia is seen in true relationship to what is received.

What is Emergy and How is it Determined?

SOLAR EMERGY: The available solar energy previously used up (directly and indirectly) to make a product or service. It's unit is the solar emjoule (sej).

This pictographic equation illustrates the emergy calculation for a hypothetical production process to make a quantity of bread carried out using only two inputs the Gibbs free energy of the rain and the available energy of the oil used in growing, harvesting, transporting, milling, baking, etc.



A Few Key Results of the Study:

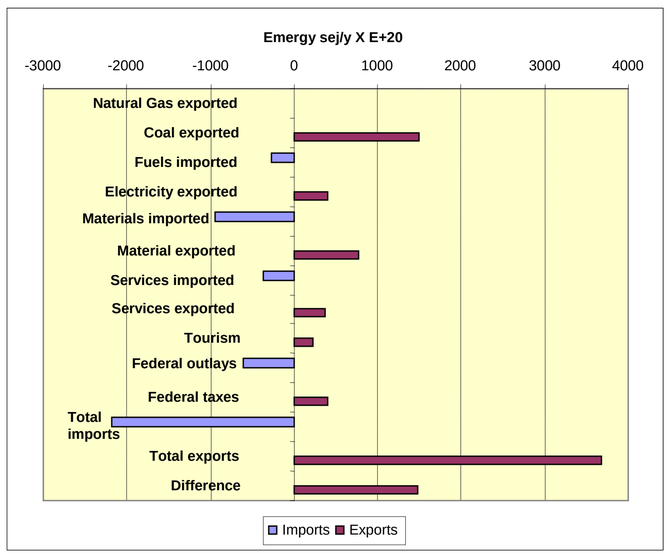
(1) West Virginia exports nearly twice (1.92:1) as much real wealth (emergy) as it receives, resulting in an imbalance of 1.46E+23 sej/y. In contrast, the monetary exchange is nearly balanced with a ratio of exports to imports of 0.998:1.

(2) The emergy of coal exported (1.497E+23sej/y) accounts for the difference between imports and exports.

(3) 63% of the tonnage (largely determined by coal) of West Virginia's exports goes to destinations on the Eastern seaboard and to several Mid-Western states. In addition, most of the electricity (70%) generated in West Virginia is exported. Thus, much of West Virginia's real wealth supports the higher standards of living found in surrounding regions. **West Virginia is the ultimate team player!**

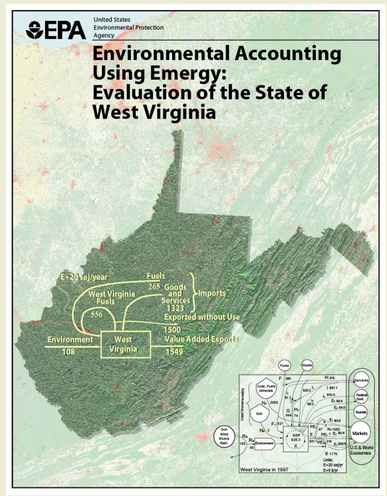
(4) A warning! West Virginia's low investment ratio (2.39:1) and high environmental loading ratio (20:1) show that it is in a precarious position, with abundant nonrenewable resources to support further economic development matched with considerable environmental degradation due to past and present economic activities.

The Exchange of Real Wealth



The Collaboration : In September of 2001, a joint project between the Canaan Valley Institute (CVI), a private nonprofit corporation headquartered in Thomas, WV and the USEPA's Office of Research and Development (ORD) was begun: (1) to assess the environmental, social, and economic system in West Virginia and (2) to evaluate the integrated effects of environmental policies on multiple scales. This emergy analysis of West Virginia was performed as a part of this research. It gives an overview of the state as an environmental system and supplies key indices needed for the emergy analysis of watershed restoration.

The Product:



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